

1. Apparatus for synchronizing a clock with data received via an asynchronous transmission medium, comprising:
  - a plurality of buffers connected to said asynchronous transmission medium;
  - circuitry configured for reading out data from said buffers at a clock rate specified by said clock; and
  - a regulating circuit configured to regulate said clock rate according to transmission rate of said data.
2. The apparatus according to Claim 1 wherein:
  - said regulating circuit regulates said clock rate so that said data is read out from said buffers at a rate substantially equal to a rate at which said data is transmitted via said asynchronous transmission medium.
3. The apparatus according to Claim 2 wherein:
  - said data is input to said transmission medium at a predetermined constant rate; and
  - said clock rate is initially set to said predetermined constant rate.
4. The apparatus according to Claim 1 wherein:
  - said data is input to said transmission medium at a predetermined constant rate;
  - said clock rate is initially set to said predetermined constant rate;
  - said buffers are circularly arranged;
  - said readout circuit commences reading said data out of said buffers when said buffers are filled to a predetermined portion of their capacity; and
  - said regulating circuit regulates said clock rate so that said readout circuit is reading out data from said buffers at a first position that is behind a second position at which said data is being received by said buffers from said transmission medium by an amount substantially equal to said predetermined portion.

5. The apparatus according to Claim 1 wherein:

data received from said transmission medium is organized into packets;

associated with each packet is a sequence field identifying transmission order of packets;

said plurality of buffers comprises circularly arranged buffers, each allocated to a sequential one of said packets according to said sequence field, whereby packets are stored in order of transmission regardless of order of reception;

associated with said buffers is a discrimination circuit configured to determine according to said sequence field whether a packet has been received by such time as its corresponding buffer is to be read out; and

a packet received after readout of its corresponding buffer commences is discarded, whereby loss of a packet in transmission does not affect timing relationships among other packets.

6. The apparatus according to Claim 1 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium, and wherein said regulating circuit regulates said clock according to a ratio of a number of packets received during a predetermined period and a number of packets synchronously transmitted during said predetermined period.

7. The apparatus according to Claim 1 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium, and wherein said regulating circuit regulates said clock according to a ratio of a time between two successively received packets and a time between synchronous transmission of two successive packets.

8. The apparatus according to Claim 1 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous,

and wherein said regulating circuit regulates said clock according to a rate of change of transmission delay occurring in said transmission medium.

[illegible]

5

regulating means for regulating said clock rate according to a rate of transmission of said data.

5

20

5

out data from said buffers at a first position that is behind a second position at which said data is being received by said buffers from said transmission medium by an amount substantially equal to said predetermined portion.

13. The means according to Claim 9 wherein:

data received from said transmission medium is organized into packets;

associated with each packet is a sequence field identifying transmission order of packets;

5 said buffers comprise a circularly arranged plurality of storage blocks, each allocated to a sequential one of said packets according to said sequence field, whereby packets are stored in order of transmission regardless of order of reception;;

associated with said buffers is a discrimination means for determining according to said sequence field whether a packet has been received by such time as its corresponding buffer is to be read out; and

10 a packet received after readout of its corresponding buffer commences is discarded, whereby loss of a packet in transmission does not affect timing relationships among other packets.

14. The means according to Claim 9 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium,

and wherein said regulating means regulates said clock according to a ratio of a number of packets received during a predetermined period and a number of packets synchronously transmitted during said predetermined period.

15. The means according to Claim 9 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium,

20 and wherein said regulating means regulates said clock according to a ratio of a time between two successively received packets and a time between synchronous transmission of two successive packets.

16. The means according to Claim 9 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous,

30 and wherein said regulating means regulates said clock according to a rate of change of transmission delay occurring in said transmission medium.

17. A method of synchronizing a clock, comprising:

receiving data from an asynchronous transmission medium;  
buffering blocks of data received from said transmission medium;  
reading out buffered data at a rate specified by said clock; and  
regulating said clock rate according to a transmission rate of said data.

18. The method according to Claim 17 wherein:

said regulating step regulates said clock rate so that said buffered data is read out at a rate substantially equal to a rate at which said data is currently being transmitted via said asynchronous transmission medium.

19. The method according to Claim 18 wherein said data is input to said transmission medium at a predetermined constant rate, and the method includes the step of:

initially setting said clock rate to said predetermined constant rate.

20. The method according to Claim 17 wherein:

said data is input to said transmission medium at a predetermined constant rate;  
said clock rate is initially set to said predetermined constant rate;  
said buffering uses circularly arranged buffers;

said step of reading out data commences reading said data out of said buffers when said buffers are filled to a predetermined portion of their capacity; and

said regulating step regulates said clock rate so that said readout circuit is reading out data from said buffers at a first position that is behind a second position at which said data is being received by said buffers from said transmission medium by an amount substantially equal to said predetermined portion.

21. The method according to Claim 17 wherein:

data received from said transmission medium is organized into packets;

associated with each packet is a sequence field identifying transmission order of packets;

5 said buffering employs a circularly arranged plurality of buffers, each allocated to a sequential one of said packets according to said sequence field, whereby packets are stored in order of transmission regardless of order of reception;

and the method further includes the steps of:

10 determining according to said sequence field whether a packet has been received by such time as its corresponding buffer is to be read out; and

discarding a packet received after readout of its corresponding buffer commences, whereby loss of a packet in transmission does not affect timing relationships among other packets.

15 22. The method according to Claim 17 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium, and wherein said regulating step comprises regulating said clock according to a ratio of a number of packets received during a predetermined period and a number of packets synchronously transmitted during said predetermined period.

20 23. The method according to Claim 17 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium, and wherein said regulating step comprises regulating said clock according to a ratio of a time between two successively received packets and a time between synchronous transmission of two successive packets.

25 24 The method according to Claim 17 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous, and wherein said regulating step comprises regulating said clock according to a rate of change of transmission delay occurring in said transmission medium.

30

25. A PBX distributed in at least two cabinets interconnected by an asynchronous transmission medium comprising:

a clock in at least one of said cabinets;

a plurality of buffers in said at least one of said cabinets configured to buffer data

5 received over said asynchronous transmission medium;

wherein said clock is configured to clock said buffers;

wherein a clock rate of said clock is controlled by a rate of transmission of said data.

26. The PBX according to Claim 25 wherein:

said clock rate is controlled so that said data is read out from said buffer means at a rate substantially equal to a rate at which said data is currently being transmitted via said asynchronous transmission medium.

27. The PBX according to Claim 26 wherein:

said data is input to said transmission medium at a predetermined constant rate; and  
said clock rate is initially set to said predetermined constant rate.

28. The PBX according to Claim 25 wherein:

said data is input to said transmission medium at a predetermined constant rate;

20 said clock rate is initially set to said predetermined constant rate;

said buffers are circularly arranged;

said reading data out of said buffers commences means when said buffers are filled to a predetermined portion of their capacity; and

25 said clock rate is controlled so that said reading out data from said buffers is at a first position that is behind a second position at which said data is being received by said buffers from said transmission medium by an amount substantially equal to said predetermined portion.

R1  
 Cont.  
 10  
 15  
 20  
 25

29. The PBX according to Claim 25 wherein:

data received from said transmission medium is organized into packets;

associated with each packet is a sequence field identifying transmission order of packets;

5 said buffers comprise a circularly arranged plurality of storage blocks, each allocated to a sequential one of said packets according to said sequence field, whereby packets are stored in order of transmission regardless of order of reception;

associated with said buffers is a discrimination means for determining according to said sequence field whether a packet has been received by such time as its corresponding buffer is to be read out; and

10 a packet received after readout of its corresponding buffer commences is discarded, whereby loss of a packet in transmission does not affect timing relationships among other packets.

30. The PBX according to Claim 25 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium,

15 and wherein said clock rate is controlled according to a ratio of a number of packets received during a predetermined period and a number of packets synchronously transmitted during said predetermined period.

31. The PBX according to Claim 25 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium,

20 and wherein said clock rate is controlled according to a ratio of a time between two successively received packets and a time between synchronous transmission of two successive packets.

32. The PBX according to Claim 25 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous,

30 and wherein said clock rate is controlled according to a rate of change of transmission delay occurring in said transmission medium.



33. Computer programs embodied in a tangible medium for synchronizing a clock with a transmission rate of data received via an asynchronous transmission medium, comprising instructions directing an arithmetic and logic unit (ALU) to:

store blocks of data received from said transmission medium in a plurality of buffers;  
read out said data from said buffers at a rate specified by said clock; and  
regulate said clock rate according to a rate of transmission of said data.

34. The computer programs according to Claim 33 wherein:

said instructions direct the performance of said regulating of said clock such that said data is read out from said buffers at a rate substantially equal to a rate at which said data is currently being transmitted via said asynchronous transmission medium.

35. The computer programs according to Claim 34 wherein said data is input to said transmission medium at a predetermined constant rate, and wherein said instructions direct the ALU to initially set said clock rate to said predetermined constant rate.

36. The computer programs according to Claim 33 wherein:

said data is input to said transmission medium at a predetermined constant rate;  
said computer programs instruct said ALU to initially set said clock rate to said predetermined constant rate;

said buffers are circularly arranged;  
said instructions direct that said reading out of data from said buffers commences when said buffers are filled to a predetermined portion of their capacity; and

said instructions direct said regulating said clock rate such that said readout circuit is reading out data from said buffers at a first position that is behind a second position at which said data is being received by said buffers from said transmission medium by an amount substantially equal to said predetermined portion.

37. The computer programs according to Claim 33 wherein:

data received from said transmission medium is organized into packets;

associated with each packet is a sequence field identifying transmission order of packets;

said plurality of buffers comprises a circularly arranged plurality of buffers, each allocated to a sequential one of said packets according to said sequence field, whereby packets are stored in order of transmission regardless of order of reception;

and the computer programs further direct said ALU to:

determine according to said sequence field whether a packet has been received by such time as its corresponding buffer is to be read out; and

discard a packet received after readout of its corresponding buffer commences, whereby loss of a packet in transmission does not affect timing relationships among other packets.

38. The computer programs according to Claim 33 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium,

and wherein said instructions regulate said clock according to a ratio of a number of packets received during a predetermined period and a number of packets synchronously transmitted during said predetermined period.

39. The computer programs according to Claim 33 wherein said data is organized into packets and said data was synchronous data prior to transmission via said asynchronous transmission medium.

and wherein said instructions regulate said clock according to a ratio of a time between two successively received packets and a time between synchronous transmission of two successive packets.

According to  
chronous da  
tions regu  
said trans

41. A propagated signal comprising synchronous data input by a telephone switch at a synchronous rate to an asynchronous transmission medium.

42. The propagated signal according to Claim 41 input to said asynchronous transmission medium for transmission to another telephone switch.

43. The propagated signal according to Claim 41 wherein said synchronous data is digital data and is organized into packets transmitted at a predetermined rate.

44. The propagated signal according to Claim 42 wherein said synchronous data is digital data and is organized into packets transmitted at a predetermined size.

45. The propagated signal according to Claim 42 comprising digital data representing audio telephone data.

46. The propagated signal according to Claim 45 further comprising telephone signaling.

[illegible]